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OEC - 1090
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15 November 1960

MEMORANDUM FOR : Chief, Development Branch, OPS-DD/P

SUBJECT : To Turn or Not To Turn,
That is the Conjecture.

1. An analytical study of flying at a constant bank angle produced the following results:

Angle of Bank	Turn Radius	Distance From Course*	Additional Miles Flown*
1°	2,935	4.5	0.8
2°	1,472	10.0	1.9
3°	984	15.0	3.1
4°	740	21.5	5.0
5°	589	29.0	7.5
6°	489	37.0	11.0
7°	418	47.0	16.0
8°	365	60.0	22.5

*Based on assumption that straight line distance from target A to target B is 400 nautical miles.

2. From these results, a limited set of conclusions can be drawn:

A. The distance between targets establishes the maximum bank angle that can be flown. This distance cannot be less than twice the turn radius, thus, for a 1,000 mile range, the limiting bank angle would be approximately 5.5°.

B. Small angles of bank do not appreciably alter the course from that of a straight line. A constant bank angle of 4° causes only a 21.5 nautical mile deviation from course. This point, 200 miles from the starting point, subtends an angle difference of 5.14°.

C. A straight line flight path to an equal distance from course would show a constant deviation. The curved flight path would show a more rapid deviation at first, followed by an apparent correction as the apex of the curvature is approached.

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2. In a 400 mile leg, the projected deviation would be 120 miles when using an 8° bank angle. A Mach 2.0 fighter launched to intercept at the projected point could cover the 120 miles back to target in approximately 6.3 minutes. The A-12 distance of 212 miles (apex to target along the curved path) would require approximately 6.3 minutes. Thus, an intercept is possible using the maximum deception distance of an 8° bank angle turn.

3. Flying the curve flight path requires the airplane to fly further for the same target coverage. At a bank angle of 8° this required range increase is slightly over 4%. In addition some portion of the range is lost due to the banking. Both factors decrease the effective operational utilization.

3. A straight line flight path to the same deviation, a more rapid turn, and a straight line flight path to the target would not be greatly different to the radar observer. The capability to fly this profile does exist in the present INS and can be pre-planned prior to flight. Any number of such deviations can be made using the "Variable" position of the INS.

4. A modification to the camera system would be required to fly the constant-curve flight paths. Such a modification would cause a loss of photography on one side and a gain in coverage on the high side. The over-all change is an increase in square miles of coverage. However, the increase occurs in an area of less resolution and the loss occurs in a region of higher resolution.

5. No attempt is made herein to make an operational evaluation of curved vs straight flight paths. Such consideration as the random acquisition of a target due to the turn or the loss of a target for the same path, the gain or loss of a target due to cloud coverage, the ability to resolve intelligence information flying at an offset angle rather than directly over the target, etc., must necessarily be made by those whose training and competence lies with the operational aspects of the mission.

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